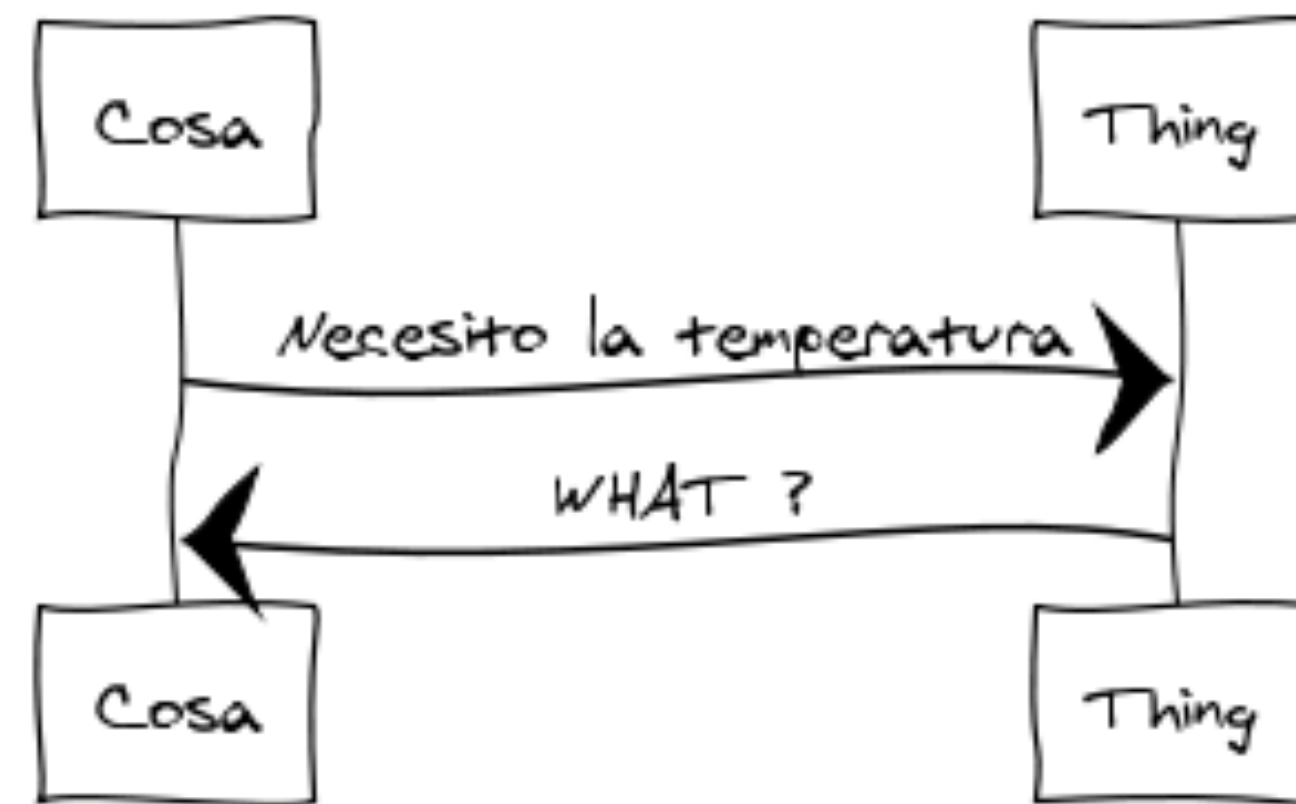


# Semantic Interoperability for IoT

Jaime Jiménez  
Senior Researcher SMN



*IoT Research Days - Oct 2016*

# IoT Work at IETF

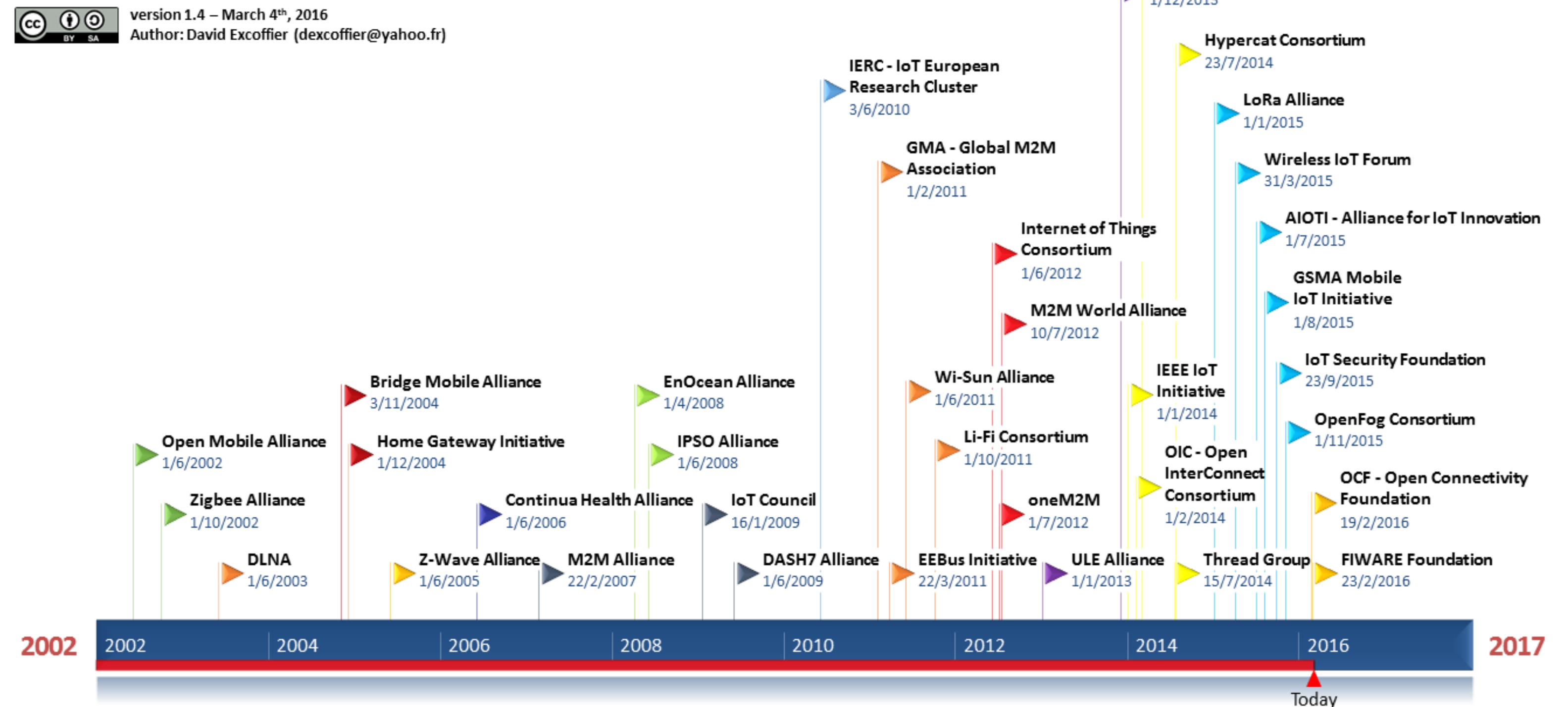
- IETF's role: Specify the underlying, fundamental Internet technologies
- “Permissionless innovation” – people can build on top – unlike App Stores or Telco-oriented services.

Run <IoT transfer protocol> over IP	Security for IoT (ACE, COSE)
Routing for low power and lossy networks	Thing-to-Thing communication (IRTF)
Web Technology for IoT (CoRE)	Architectural oversight (IAB)

# Consolidation is moving up the stack

- From closed, vertical solutions to open horizontal ones.
- Alignment on using Internet protocols. Already done on the network layer (IP, IPv6) and happening on application protocols (HTTP, CoAP, MQTT) but not there yet on the semantics.
- Many new consortia due to IoT hype.

## Internet of Things Alliances & Consortia timeline



# IAB - IOT Semantic Interoperability Workshop

March 2016

## Why?

- Consumers and other users want systems where they can acquire components from different manufacturers.
- Ability to build larger systems out of components built by different companies and for different purposes will drive innovation.

## Goals

- Facilitate introductions between relevant organizations.
- Identify opportunities for cross-organization collaboration by identifying similarities between models/systems.
- Have some lasting impact after one-time event is over.

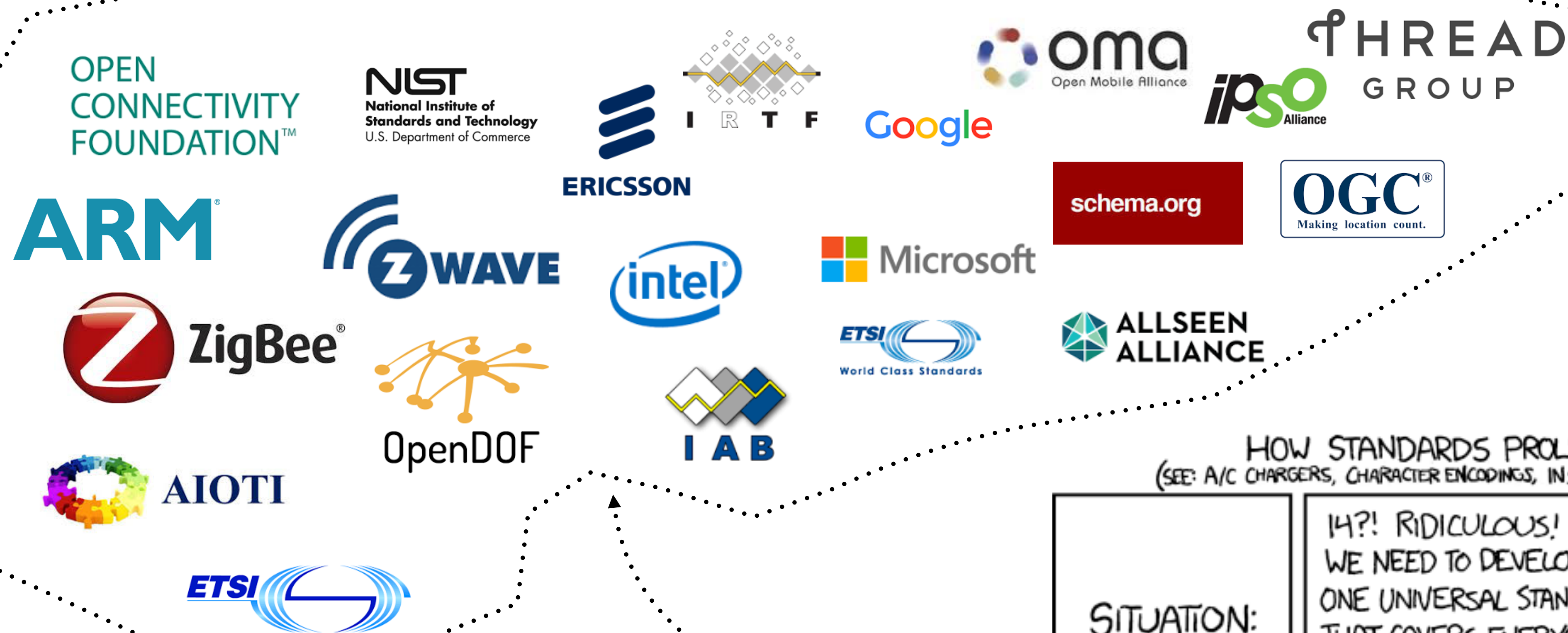


## Why IAB ?

- Internet tech and neutrality.
- Received 66 submissions (42 accepted): 17 standards organisations, vendors, operators, individuals and research organizations.



# IAB - IOT Semantic Interoperability Workshop



**“Please, no more standards”**

HOW STANDARDS PROLIFERATE:  
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)

SITUATION:  
THERE ARE  
14 COMPETING  
STANDARDS.

14?! RIDICULOUS!  
WE NEED TO DEVELOP  
ONE UNIVERSAL STANDARD  
THAT COVERS EVERYONE'S  
USE CASES.



SOON:  
SITUATION:  
THERE ARE  
15 COMPETING  
STANDARDS.

# IOTSI Workshop takeaways

## **Interaction Models**

- REST vs PubSub vs RPC calls.
- REST facilitates IoT evolution.

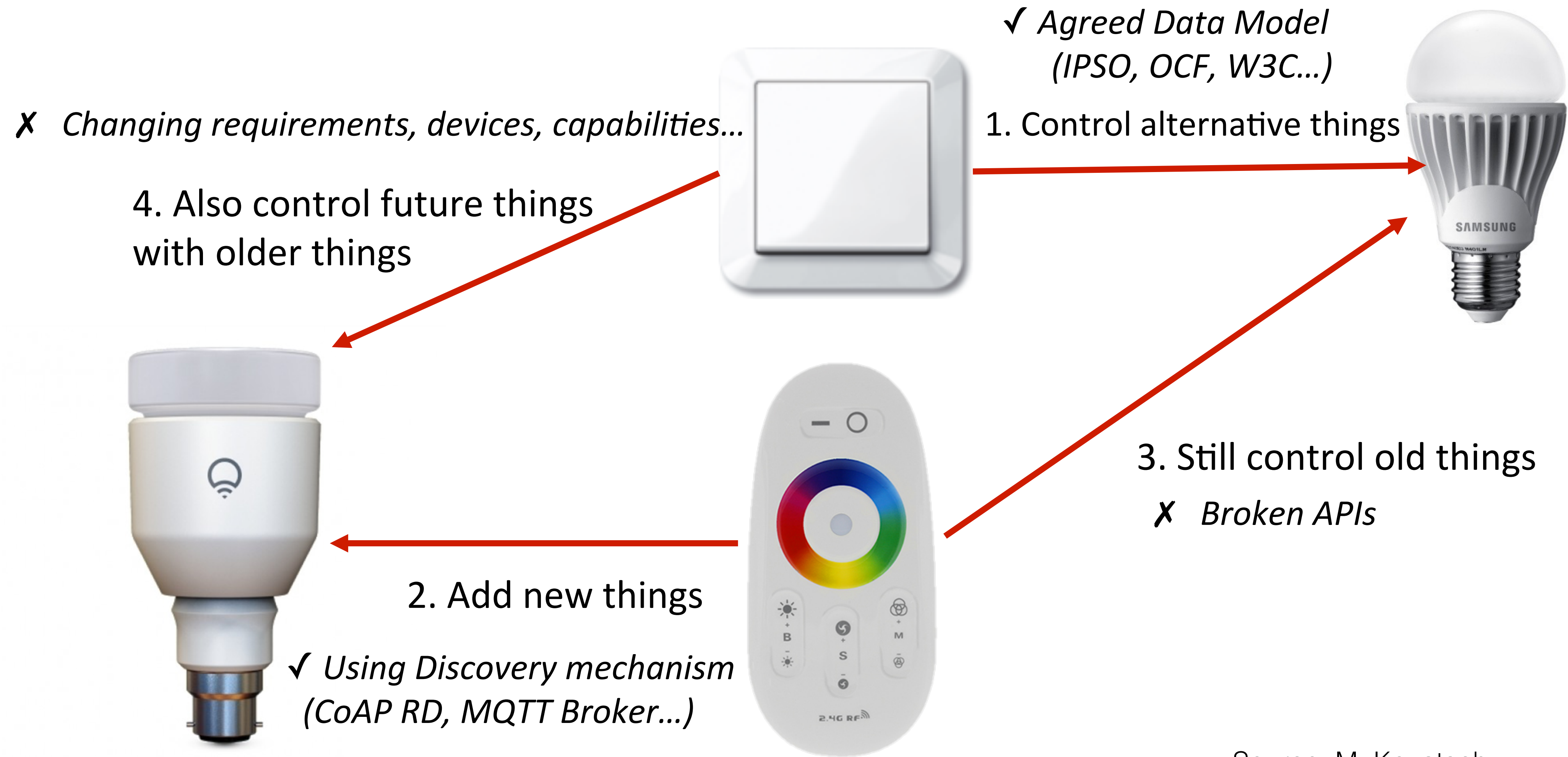
## **How and when to do translation**

- Multiple Data Models will have to coexist (at least for a while).
- Lack of common terminology (IM, DM, etc).
- Translation Hubs: Runtime translation of data vs Translating DMs.
- Loss of information when translating data models.

## **How to deal with change**

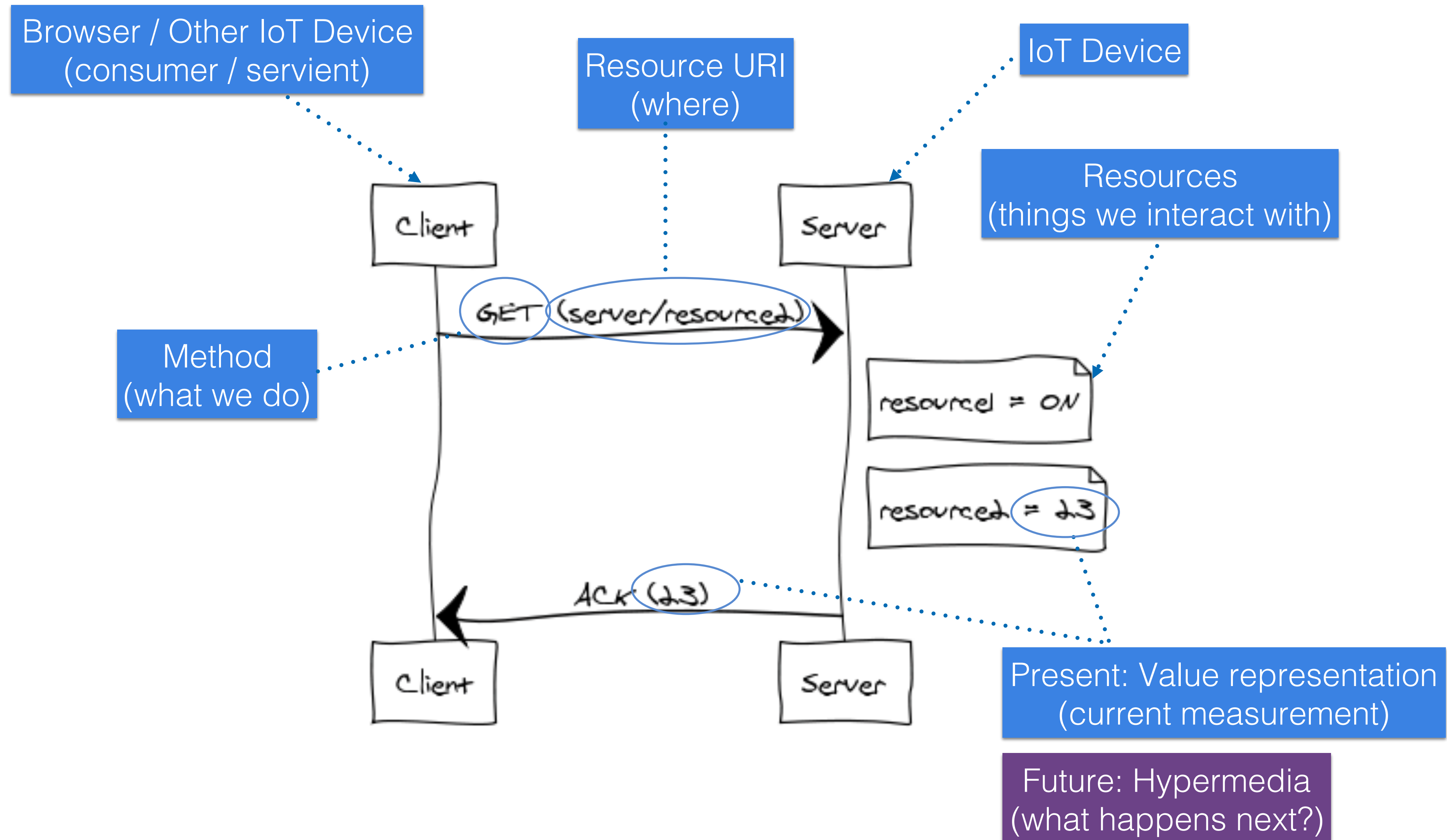
- Multiprotocol not an option for most constrained devices. Legacy is heavy.
- Need to build systems that last. Web approach.
- Hypermedia Applications vs “REST” static APIs vs Pushing Binaries.

# Ability to deal with change



Source: M. Kovatsch

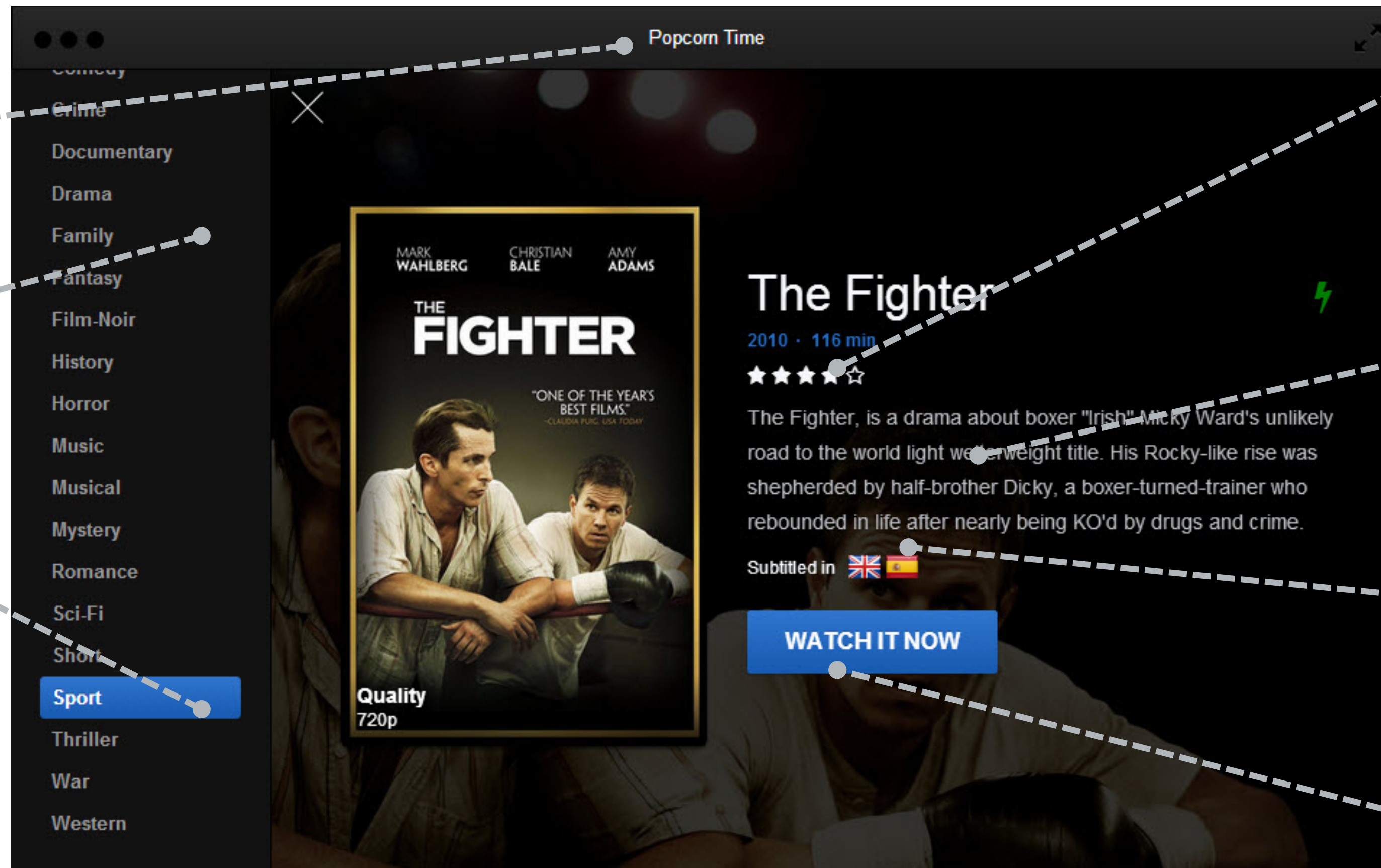
# REST interaction components for IoT (roughly)





# The power of mashups

Internal microservice APIs





# Web Mashups through Open APIs...

Internal microservice APIs

The screenshot shows the Airbnb search interface for Helsinki, Finland. The top navigation bar includes the Airbnb logo, a search bar with "Helsinki, Finland", and links for "City Hosts BETA", "Host", "Trips", "Messages", "Help", and a user profile for "Jaime". The search filters section includes "Dates" (Check in, Check out, 1 guest), "Room type" (Entire home, Private room, Shared room), and a "Price range" slider from €9 to €1,000+. Below the filters, a note states: "Enter dates to see full pricing. Additional fees apply. Taxes may be added." The main content area displays a grid of four rental listings, each with a price tag, a lightning bolt icon, and a heart icon. The listings are: "Cheap&Cozy in the ♥ of Helsinki" (€44, Entire home/apt, 2 guests, 128 reviews), "Apartment in Center of Helsinki" (€35, Entire home/apt, 2 guests, 46 reviews), "Urban studio in the Helsinki center" (€62, Entire home/apt, 3 guests, 18 reviews), and "Studio for sharing In Kampi" (€30, Shared room, 1 guest, 63 reviews). To the right of the listings is a map of Helsinki with red price tags indicating rental prices in various areas. The map includes labels for "Helsinki", "PASILA", "KALLIO", "KAISANIEMI", "RUOHOLAHTI", "SALMISAARI", "PUNAJA", "ULLANLINNA", "EIRA", "KATAJA", "Kluu", "Esplanadi", "Kaivopuisto", "Temppliaukion kirkko", "Tempelplatsens kyrka", "Linnanmäki", "Borgbacken", "Sofianlehto", "Forsbyvägen", "Metsälantie", "Tukholmankatu", "Paculankatu", "Merkankatu", "Runeberginkatu", "Lonnroinkatu", "Merikatu", "Vartunentekatu", "Seurasaareselkä", "Helsingin tuomiokirkko", "Helsingfors domkyrka", "Helsingin tuomiokirkon kirkko", "Helsingfors domkyrkans kyrka", "Helsingin tuomiokirkon kirkon kirkko", "Helsingfors domkyrkans kyrkans kyrka", "Helsingin tuomiokirkon kirkon kirkon kirkko", "Helsingfors domkyrkans kyrkans kyrkans kyrka". The map also shows "Map data ©2014" and a "Language and currency" dropdown menu.






# ... often break



31

Google Calendar Help Forum public

Actions



4


★ Can't sign in to Google calendar on my Samsung refrigerator

by Kris Spencer 11/20/14

I have a Samsung RF4289HARS refrigerator. The Google calendar app on it has been working perfectly since I purchased the refrigerator August 2012. However, with the latest changes in Google Calendar API, I can no longer sign in to my calendar. I receive a message stating "Please check your email in Google Calendar website". I can sign in fine on my home PC and have no problem seeing the calendar on my phone. Perhaps this is a Samsung issue, but I thought I would try here first. Has anyone else experienced this problem and what was the solution?

Categories: [Calendar not loading](#) [Report an issue](#)

Best Answer



4

Marc-André Beauchamp said:

12/26/14

Hi people,

For all new question about that, please make an obsolete version.

As it said in this support page <http://www.samsung.com/usa/support/solutions/faq/RF4289HARS/XAA>, please register your mail

ADD A REPLY

Google

Calendar

Email

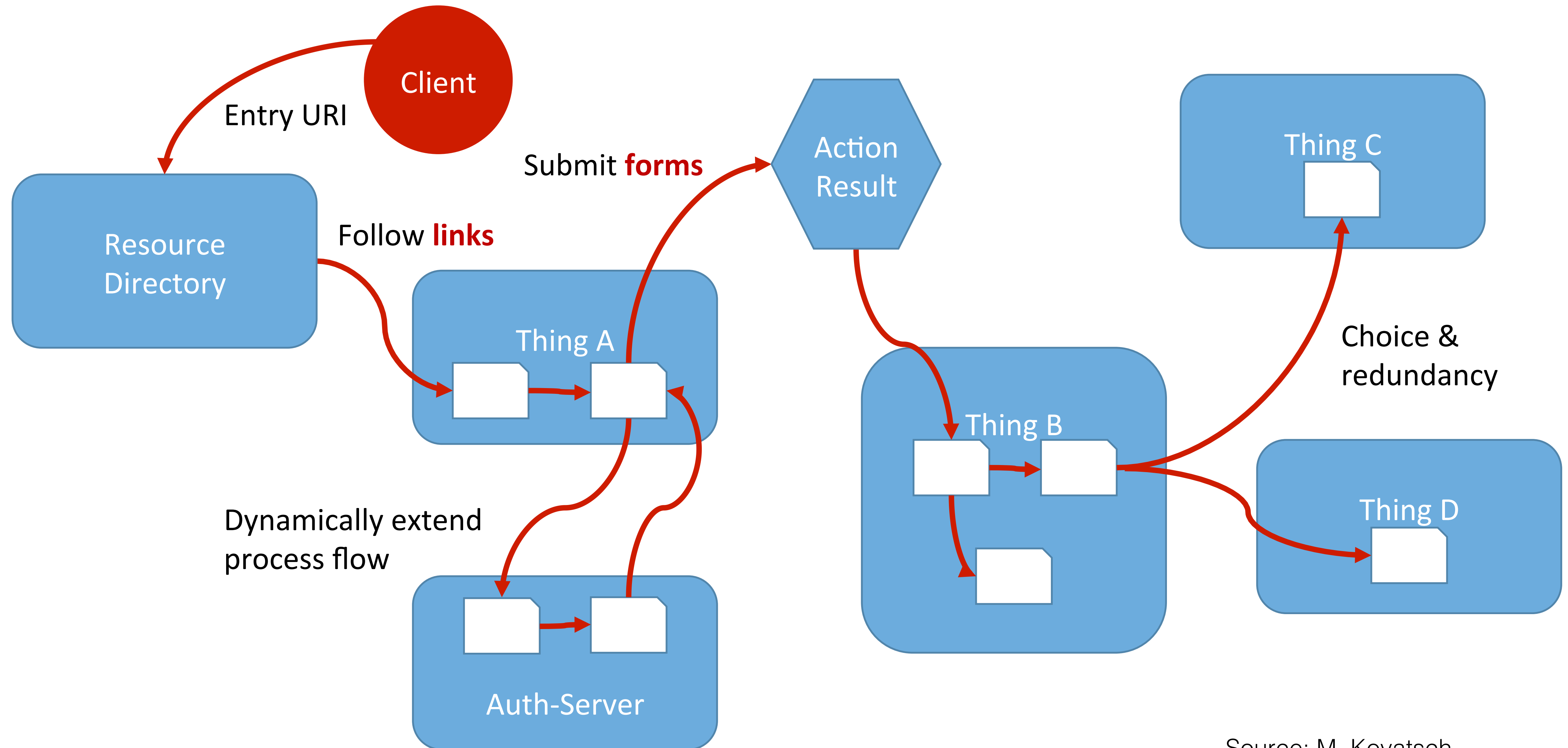
Password

Please check your email in Google Calendar website

OK

11

# Hypermedia-driven Applications (HATEOAS)



Source: M. Kovatsch



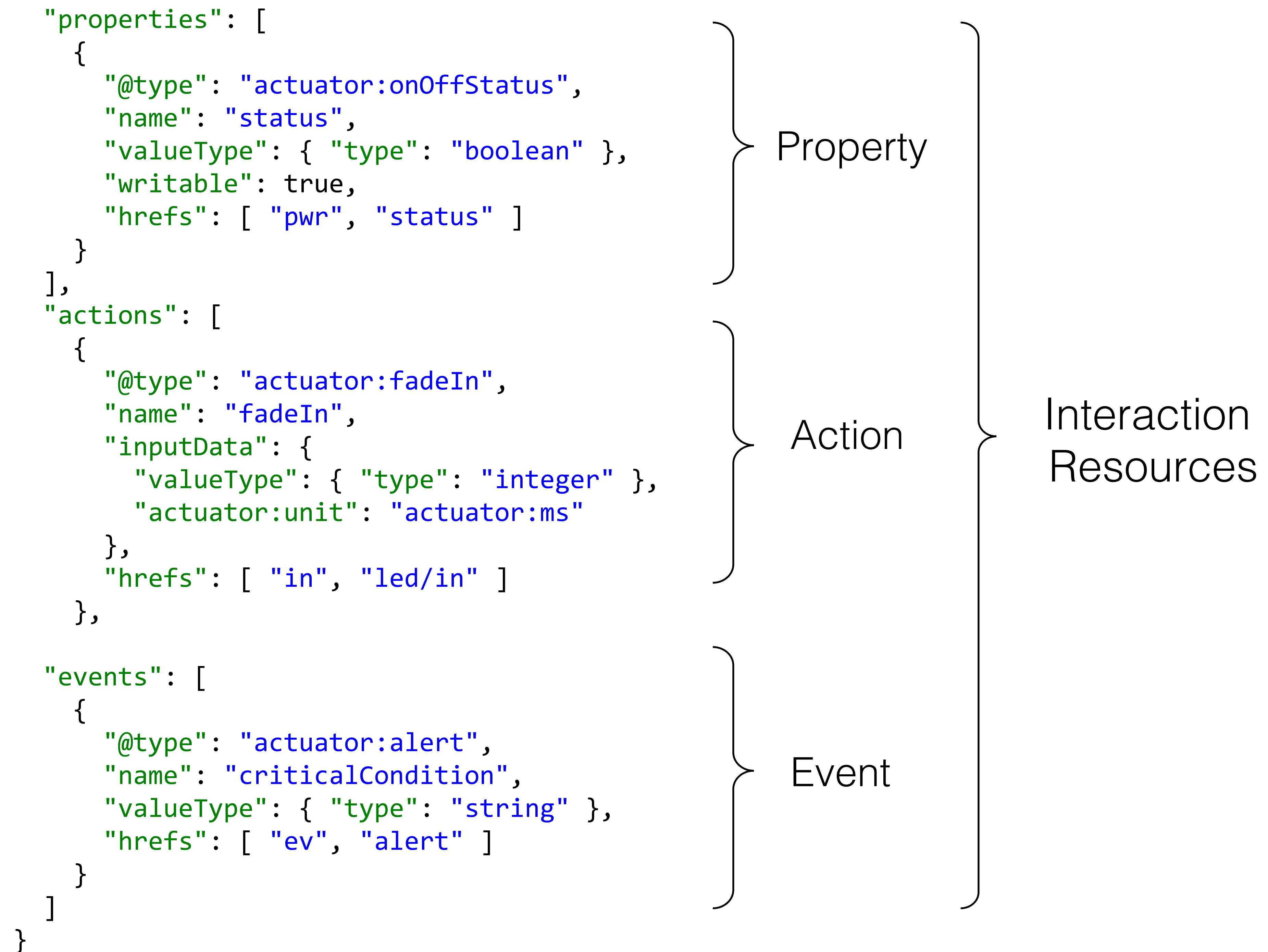
# W3C Thing Description (TD) Example

```
{
  "@context": [
    "http://w3c.github.io/wot/w3c-wot-td-context.jsonld",
    { "actuator": "http://example.org/actuator#" }
  ],

  "@type": "Thing",
  "name": "MyLEDThing",

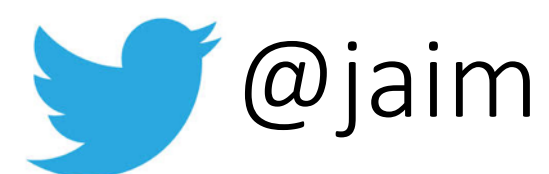
  "uris": [
    "coap://myled.example.com:5683/",
    "http://mything.example.com:8080/myled/"
  ],

  "encodings": ["JSON", "EXI"],
  "security": {
    "cat": "token:jwt",
    "alg": "HS256",
    "as": "https://authority-issuing.example.org"
  },
}
```



# Thanks & Links

	<b>IOTSI Workshop</b>	<b><a href="https://www.iab.org/activities/workshops/iotsi/">https://www.iab.org/activities/workshops/iotsi/</a></b>
Data Models	IPSO	<a href="http://ipso-alliance.github.io/pub/">http://ipso-alliance.github.io/pub/</a>
	LWM2M	<a href="https://github.com/OpenMobileAlliance/">https://github.com/OpenMobileAlliance/</a>
	W3C Interest Group	<a href="https://www.w3.org/WoT/IG/">https://www.w3.org/WoT/IG/</a>
	OneIoT	<a href="http://www.oneiota.org/">http://www.oneiota.org/</a>
REST	REST	<a href="https://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm">https://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm</a>
Hypermedia Application Languages	RESTful Web Apis	<a href="http://restfulwebapis.com">http://restfulwebapis.com</a>
	CoRAL	<a href="https://tools.ietf.org/html/draft-hartke-t2trg-coral-00">https://tools.ietf.org/html/draft-hartke-t2trg-coral-00</a>
	HSML	<a href="https://tools.ietf.org/html/draft-koster-t2trg-hsml-00">https://tools.ietf.org/html/draft-koster-t2trg-hsml-00</a>
CoAP	CoAP	<a href="https://tools.ietf.org/html/rfc7252">https://tools.ietf.org/html/rfc7252</a>
	CoRE Link-Format	<a href="https://tools.ietf.org/html/rfc6690">https://tools.ietf.org/html/rfc6690</a>
	CoRE RD	<a href="https://datatracker.ietf.org/doc/draft-ietf-core-resource-directory/">https://datatracker.ietf.org/doc/draft-ietf-core-resource-directory/</a>



[jaimejim.github.io](https://jaimejim.github.io)